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Disclaimer

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The ^{242}Pu(n,γ) cross section is important for the advanced fuel cycle initiative and the nuclear forensics program. Measurements were performed with DANCE at LANL with the intention of reducing ^{242}Pu(n,γ) cross section uncertainties and improving the signal-to-noise ratio over recent measurements [1]. This new measurement involved doubling the time the target was exposed to the beam—a proposed increase in statistics by a factor of 2. Additionally, thinner Kapton foils were used for the PPAC entrance and exit windows; this change was intended to reduce background by a factor of 6. These new experimental conditions are anticipated to yield a < 10% statistical uncertainty in the (n,γ) cross section near 10 keV (with one keV energy bin). The cross section will be determined for neutron energies ranging from thermal to about 30 keV.

A double-sided electroplated target, composed of 0.642 mg ^{242}Pu and 0.031 mg ^{239}Pu, was fabricated at LLNL; the target plating cell is detailed in Ref. [2]. Note that ^{239}Pu was added intentionally in order to extract the absolute cross section during analysis. Sandwiched between two 1.4 μm thick aluminized mylar foils, the target was installed within the PPAC [3] and acted as the cathode. Located within the PPAC 3 cm from either side of the target, 1.4 μm thick aluminized mylar foils were the anodes. Entrance and exit windows were constructed out of 13 μm thick Kapton foils. This PPAC design was used successfully in previous experiments including the ^{252}Cf spontaneous fission measurement described in Ref. [4]. During the ^{242}Pu experiment, the DANCE array acted as the primary counter and the PPAC behaved as the secondary counter.

With an estimated count rate of approximately 70 detected events per day at 10 keV (assuming a cross section of about 1 barn and a 7 mm diameter target), data were collected over 17 days with the active target installed within the PPAC, which should be able to achieve the statistical uncertainty < 10% assuming the gating efficiency of ~ 10%. An additional 7 days of data were collected with a blank target substituted for the double-sided electroplated ^{242}Pu target, and this data represent the beam-induced and environmental background.

Data analysis is currently underway. Gates on the total γ-ray energy and multiplicity will be applied, and the background dataset will be subtracted from the data collected with the active target. The absolute ^{242}Pu cross section will be determined relative to the ^{239}Pu cross section, and results will be prepared for publication.

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